

EXHIBIT B

MAOC-409000



Broadband Voltage Controlled Oscillator 6 - 12 GHz

Preliminary - Rev. V3P

Features

- Octave Tuning Bandwidth
- Phase Noise: -95 dBc/Hz @ 100 kHz
- V_{TUNE} Range: 0 - 23 V
- Low Current Consumption: 58 mA
- Excellent Temperature Stability
- +5 V Bias Supply
- Lead-Free 4 mm 24-Lead Package
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAOC-409000 is a wideband voltage controlled oscillator operating in the 6 - 12 GHz range. The VCO has flat output power and very low phase noise over its operating conditions. A single +5V bias voltage is required, and a tuning voltage of 0 - 23 V. The device is fully matched and no external matching components are required.

The MAOC-409000 has very low phase noise, stable output power over temperature and excellent tuning control, making it ideal for applications such as communications systems, test and measurement and wideband defense applications.

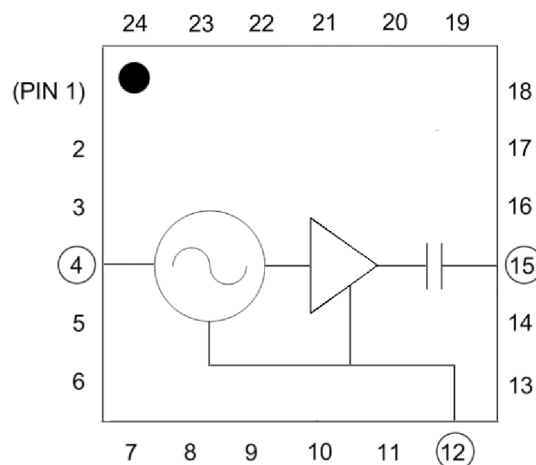
The 4 mm package has a lead-free finish that is RoHS compliant and compatible with a 260°C reflow temperature. The package features low lead inductance and an excellent thermal path.

Ordering Information¹

Part Number	Package
MAOC-409000-000PPR	bulk
MAOC-409000-SMBPPR	Sample Board

1. Reference Application Note M513 for reel size information.

Block Diagram



Pin Configuration²

Pin	Function	Pin	Function
1	GND	13	GND
2	GND	14	GND
3	GND	15	RF
4	V_{TUNE}	16	GND
5	GND	17	GND
6	GND	18	GND
7	N/C	19	N/C
8	GND	20	GND
9	GND	21	GND
10	GND	22	GND
11	GND	23	GND
12	V_{CC}	24	N/C
		25 ³	GND

2. MACOM recommends connecting unused package pins to ground.
3. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

PRELIMINARY: Data Sheets contain information regarding a product MACOM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

For further information and support please visit: <https://www.macom.com/support>

MAOC-409000
Broadband Voltage Controlled Oscillator
6 - 12 GHz
Preliminary - Rev. V3P
Electrical Specifications: $T_{op} = 25^{\circ}\text{C}$, $V_{CC} = 5\text{ V}$, $Z_0 = 50\ \Omega$

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Output Power	RF Port, 6 - 12 GHz	dBm	—	1	—
SSB Phase Noise	RF Port, 10 kHz Offset, 6 - 12 GHz RF Port, 100 kHz Offset, 6 - 12 GHz	dBc/Hz	—	-65 -95	—
Harmonics	RF Port, $2F_0$	dBc	—	-15	—
Pulling (Sensitivity to Match)	RF Port, VSWR = 2:1	MHz pk-pk	—	5	—
Pushing (Sensitivity to Supply Voltage)	RF Port, 6 - 12 GHz	MHz/V	—	10	—
Frequency Drift Rate (Sensitivity to Temperature)	RF Port, 6 - 12 GHz	MHz/ $^{\circ}\text{C}$	—	1.0	—
Output Return Loss	RF Port, 6 - 12 GHz	dB	—	6	—
Supply Current	I_{CC}	mA	—	58	—
Tune Voltage	V_{TUNE}	V	0	—	23
Tuning Current Leakage	$V_{TUNE} = 23\text{ V}$	μA	—	5	—

4. VCO can operate over the 4.75 V to 5.25 V supply voltage range.

Absolute Maximum Ratings^{5,6,7}

Parameter	Absolute Maximum
V_{CC}	+5.5 V
V_{TUNE}	25 V
Storage Temperature	-55 $^{\circ}\text{C}$ to +150 $^{\circ}\text{C}$
Operating Temperature	-40 $^{\circ}\text{C}$ to +85 $^{\circ}\text{C}$
Junction Temperature ⁸	+135 $^{\circ}\text{C}$

5. Exceeding any one or combination of these limits may cause permanent damage to this device.
6. MACOM does not recommend sustained operation near these survivability limits.
7. Operating at nominal conditions with $T_J \leq +135^{\circ}\text{C}$ will ensure MTBF > TBD hours.
8. Junction Temperature (T_J) = $T_C + \Theta_{jc} * (V * I)$
 Typical thermal resistance (Θ_{jc}) = 43 $^{\circ}\text{C/W}$.
 a) For $T_C = 25^{\circ}\text{C}$, $T_J = 37^{\circ}\text{C}$ @ 5 V, 58 mA
 b) For $T_C = 85^{\circ}\text{C}$, $T_J = 97^{\circ}\text{C}$ @ 5 V, 58 mA

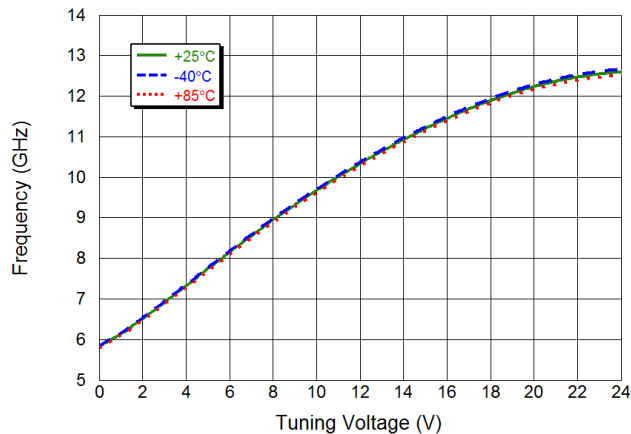
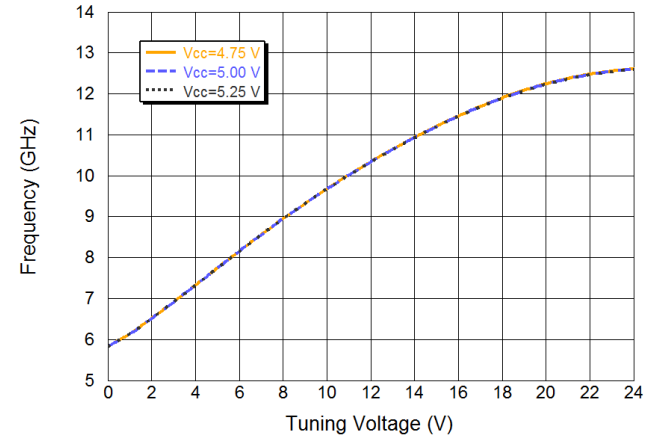
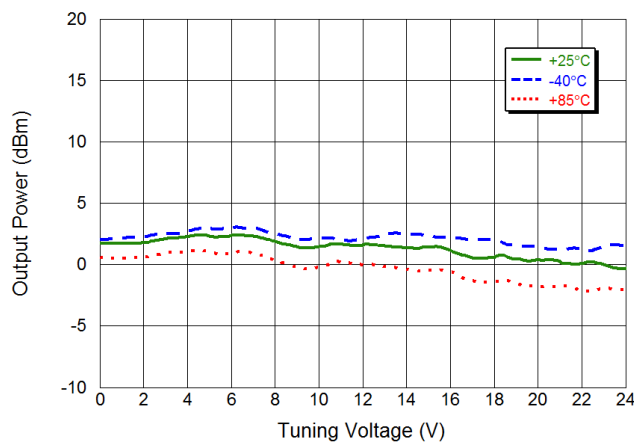
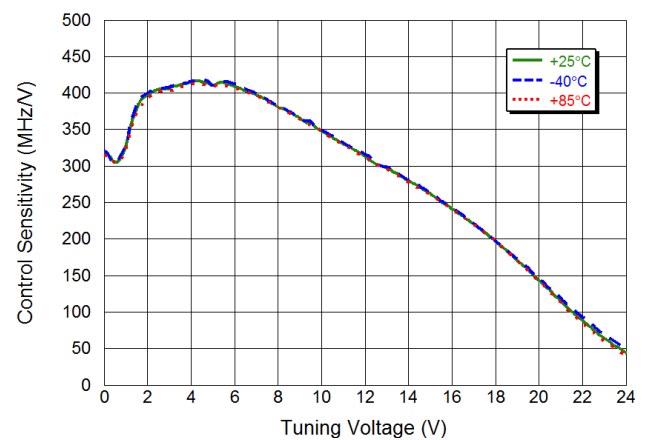
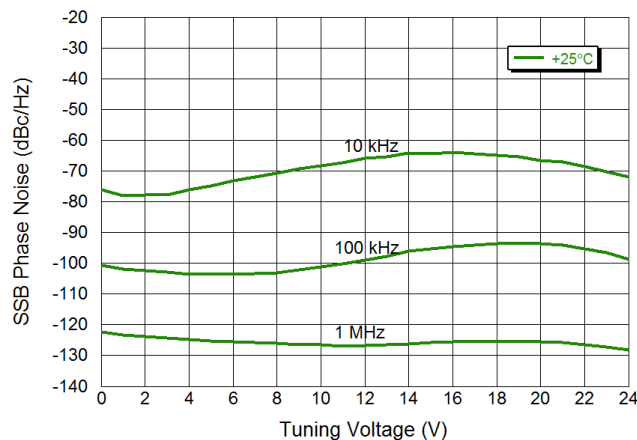
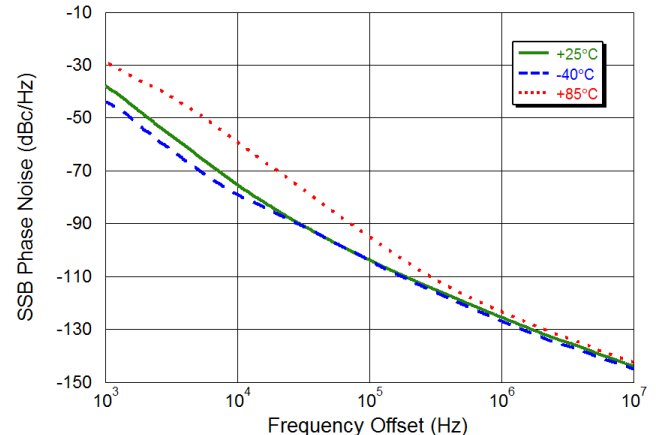
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used.

Preliminary Information

MAOC-409000
Broadband Voltage Controlled Oscillator
6 - 12 GHz
Preliminary - Rev. V3P
Typical Performance Curves: $V_{CC} = 5\text{ V}$, $T_A = +25^\circ\text{C}$ (unless otherwise indicated)
Output Frequency vs. Tune Voltage**Output Frequency vs. Tune/Supply Voltage****Output Power vs. Tune Voltage****Output Power vs. Tune/Supply Voltage****Phase Noise vs. Tune Voltage****Phase Noise vs. Frequency Offset ($V_{TUNE} = 5\text{ V}$)**

PRELIMINARY: Data Sheets contain information regarding a product MACOM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

For further information and support please visit: <https://www.macom.com/support>

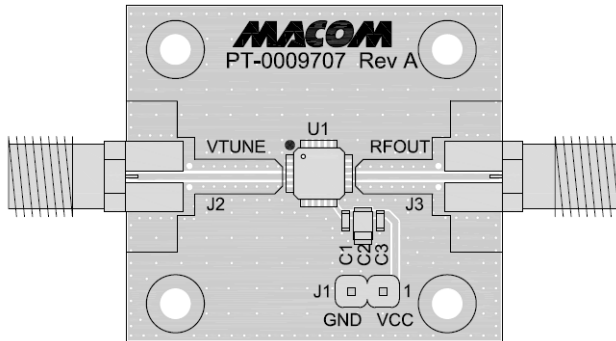
MAOC-409000



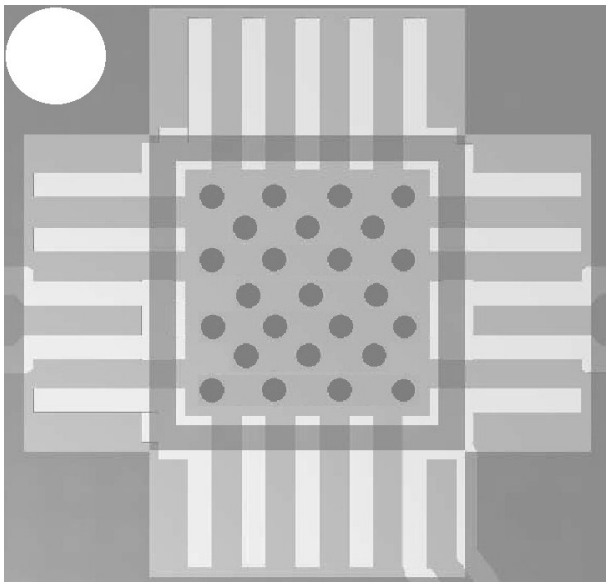
Broadband Voltage Controlled Oscillator 6 - 12 GHz

Preliminary - Rev. V3P

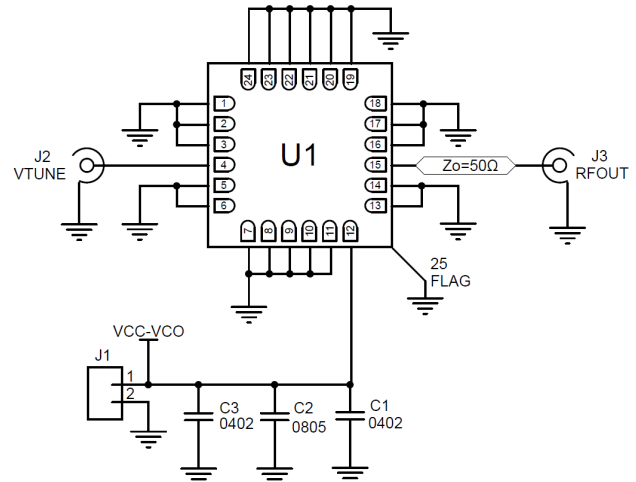
Sample Board Layout



PCB Land Pattern



Sample Board Schematic⁹




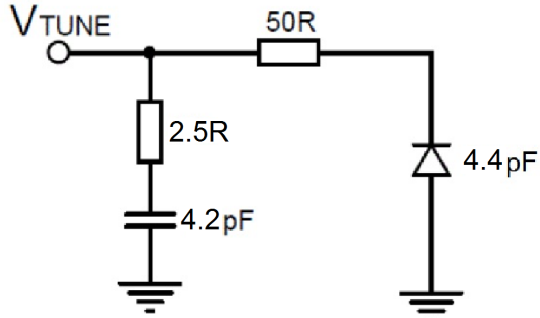
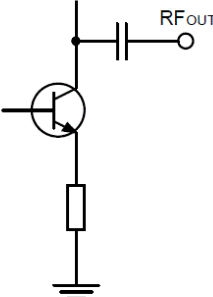
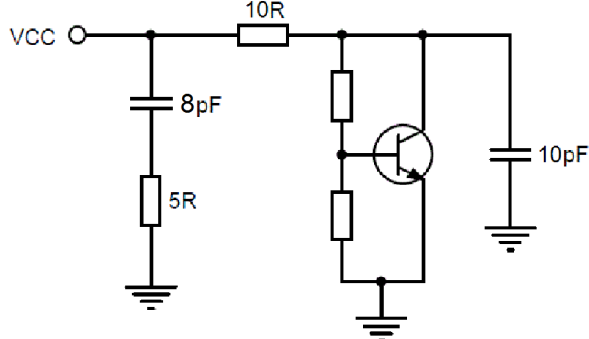
9. All N/C and GND pins should be connected to RF/DC ground.

Parts List

Component	Description
PCB	PT-0009707 SMB, Rogers RO4350B
U1	MAOC-409000
C1	CAP, 100 pF, 0402 Case size
C2	CAP, 10 μ F, 0805 Case Size
C3	CAP, 0.1 μ F, 0402 Case Size
J1	DC Header
J2	RF Connector, SMA
J3	RF Connector, SMA HF, Johnson

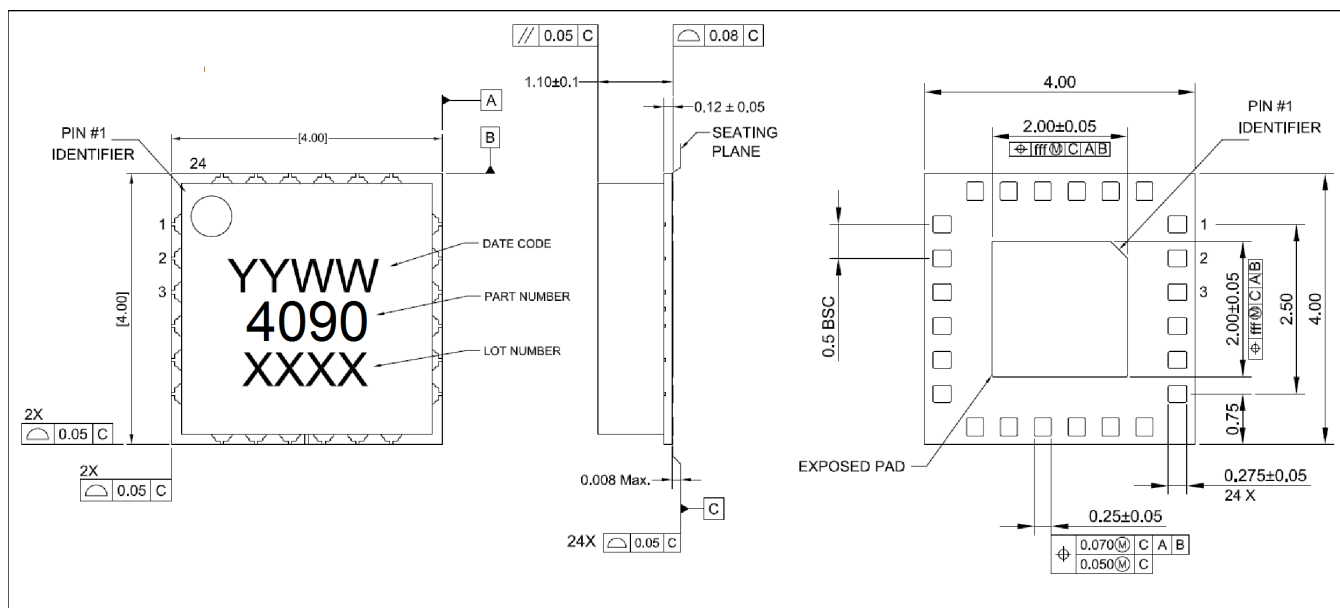
Preliminary Information

MAOC-409000**MACOM**TM**Broadband Voltage Controlled Oscillator
6 - 12 GHz****Preliminary - Rev. V3P****Pin Descriptions**

Pin No.	Function	Description	Equivalent Interface Schematic
7, 19, 24	N/C	No connect pins. These pins should be connected to RF/DC ground.	
1-3, 5, 6, 8-11, 13, 14, 16-18, 20-23, 25	GND	Ground pins. These pins should be connected to RF/DC ground.	
4	V _{TUNE}	VCO tune voltage input	
15	RF	VCO RF output. Internally DC blocked.	
12	V _{CC}	VCO supply voltage.	

Preliminary Information

Lead-Free 4 mm 24-Lead Package[†]



† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 3 requirements.
Plating is NiPdAu over Copper

Preliminary Information

MAOC-409000
**Broadband Voltage Controlled Oscillator
6 - 12 GHz**
Preliminary - Rev. V3P
Preliminary Information

MACOM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with MACOM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.

7

PRELIMINARY: Data Sheets contain information regarding a product MACOM has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

MACOM Technology Solutions Inc. (MACOM) and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

For further information and support please visit: <https://www.macom.com/support>

DC-0012120